WHAT SHOULD I PLANT?

Suggested Grade
> 8

SD Mathematics Strand & Standard *(Primary for Task)*
> Statistics & Probability
>> 8.S.1.2. Students are able to use a variety of visual representations to display data to make comparisons and predictions.

Task Summary
> Students will demonstrate their understanding of statistical representation by selecting appropriate graph types, correctly representing data, and justifying conclusions based on the data.

Time and Context of Task
> Two 50 minute class periods. Students should already be proficient at different visual representations of data and statistical calculations.

Materials Needed
> Crop data, graph paper

Author and Lead Teacher for the Task
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WHAT SHOULD I PLANT?

You have been charged with the duty of deciding what type of wheat to plant on the family farm next year. You have historical data for the yields of both types of wheat (winter and spring.)

Working in a small group, create at least two different graphical representations of each set of data. Calculate the mean, median, mode, and range for each set of data.

Based on your graphs and the summary statistics that you have calculated, make a written recommendation for the type of wheat to plant next year. Explain the reasoning for your recommendation.
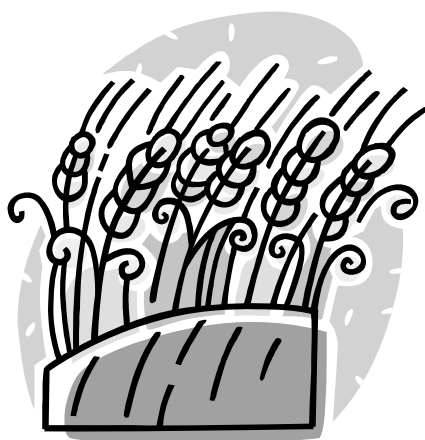
CONTENT STANDARDS

Primary Standard

Strand Name:	Statistics & Probability
SD Goal:	Students will apply statistical methods to analyze data and explore probability for making decisions and predictions.
Indicator:	Use statistical models to gather, analyze, and display data to draw conclusions.
Standard:	8.S.1.2. Students are able to use a variety of visual representations to display data to make comparisons and predictions.

Supplemental Standard

Strand Name:	Statistics & Probability
SD Goal:	Students will apply statistical methods to analyze data and explore probability for making decisions and predictions.
Indicator:	Use statistical models to gather, analyze, and display data to draw conclusions.
Standard:	8.S.1.1. Students are able to find the mean, median, mode, and range of a data set from a stem-and-leaf plot and a line plot.

NCTM Process Standard

Communication

- Use the language of mathematics to express mathematical ideas precisely.
- Communicate their mathematical thinking coherently and clearly to peers, teachers, and others.

Connections

- Recognize and apply mathematics in contexts outside of mathematics.

Problem-Solving Strategies

- Drawing pictures, graphs, and tables
- Looking for patterns

ASSESSMENT TOOLS

Task Rubric

Category	Advanced	Proficient	Basic	Below basic
8.S.1.2. Students are able to use a variety of visual representations to display data	Displays the data in appropriate two or more types of graphs with strong visual appeal	Chooses two or more appropriate types of graphs.	Chooses one appropriate graph	Chooses an inappropriate graphical form or provides no graph
8.S.1.2. Uses displays of data to make comparisons and predictions	Draws and justifies valid and precise conclusions about type of wheat to plant.	Draws and justifies one valid conclusion about type of wheat to plant based on some of the data	Draws a valid conclusion that the student does not justify using the data	Draws no conclusion or draws an invalid conclusion.
Correctness of representation of data	Correctly represents the data with strong visual appeal.	Correctly represents the data.	Has some inaccuracies in the representation of the data.	Fails to represent the data or has gross misrepresentations
8.S.1.1. Students are able to find the mean, median, mode, and range of a data set from a stem-and-leaf plot and a line plot.	Creates a stem-and-leaf plot or a line plot for the data and correctly finds summary statistics for both data sets.	Correctly finds summary statistics for both data sets.	Correctly finds some of the summary statistics for the data sets.	Fails to find any of the summary statistics for the data sets.
Mathematical terminology and notation	Correct terminology and notation are always used, making it easy to understand what was done.	Correct terminology and notation are usually used, making it fairly easy to understand what was done.	Correct terminology and notation are used, but it is sometimes not easy to understand what was done.	There is little use, or a lot of inappropriate use, of terminology and notation.
Neatness and organization	The work is presented in a neat, clear, organized fashion that is easy to read.	The work is presented in a neat and organized fashion that is usually easy to read.	The work is presented in an organized fashion but may be hard to read at times.	The work appears sloppy and unorganized. It is hard to know what information goes together.

Eighth Grade Statistics & Probability
Performance Descriptors

Advanced	**Eighth grade students performing at the advanced level:** • choose the measure of central tendency that best represents the data; • make predictions using probability for two independent events.
Proficient	**Eighth grade students performing at the proficient level:** • represent data in various forms and use results to make predictions and comparisons; • find measures of central tendency; • compute the probability for two independent events.
Basic	**Eighth grade students performing at the basic level:** • represent data in various forms; • find the mean and mode of a given set of data; • find the probability of a simple event.

Eighth Grade Statistics & Probability
ELL Performance Descriptors

Proficient	**Eighth grade ELL students performing at the proficient level:** • gather, organize, and represent data in various forms to make comparisons; • compute probability of two events occurring at the same time; • read, write, and speak the basic language of statistics and probability.
Intermediate	**Eighth grade ELL students performing at the intermediate level:** • represent data in various forms; • determine measures of central tendency given a set of data; • find the probability of simple events; • read and answer questions about data in basic graphs; • explain in mathematical terms the sequence of steps used in solving problems; • give simple oral or written responses to directed questions on topics presented in class.
Basic	**Eighth grade ELL students performing at the basic level:** • determine outcomes of events using coins, dice, spinners, etc.; • recognize and use basic statistics and probability terms; • respond to yes or no questions and to problems presented pictorially or numerically in class.
Emergent	**Eighth grade ELL students performing at the emergent level:** • copy and write statistics and probability symbols and figures; • imitate pronunciation of statistics and probability terms; • use non-verbal communication to express mathematical ideas.
Pre-emergent	**Eighth grade ELL students performing at the pre-emergent level:** • observe and model appropriate cultural and learning behaviors from peers and adults; • listen to and observe comprehensible instruction and communicate understanding non-verbally.

WHAT SHOULD I PLANT?
Student Work Samples

As you examine the samples, consider the following questions:
- In light of the standard/s addressed and the assessment tools provided, what evidence does the work provide that students are achieving proficiency in the knowledge and skills addressed by the standard/s for the task?
- Is the task/activity well designed to help students acquire knowledge and demonstrate proficiency? Is the task/activity clearly aligned with the standards? In what ways would you adapt the task/activity to better meet the needs of your students?

Winter Wheat

Mean- 34

Median- 34

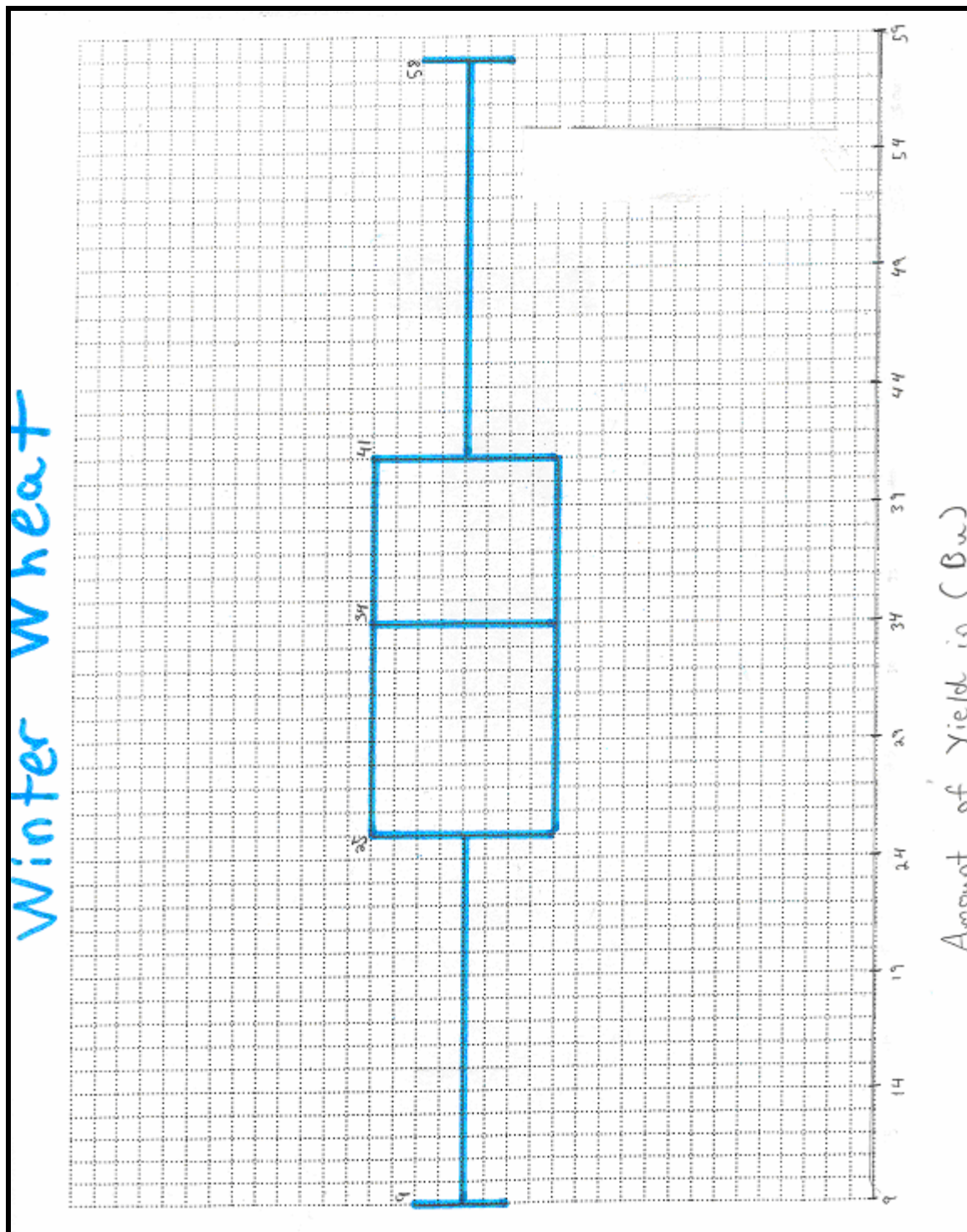Mode- 29, 33, 38

Range- 49

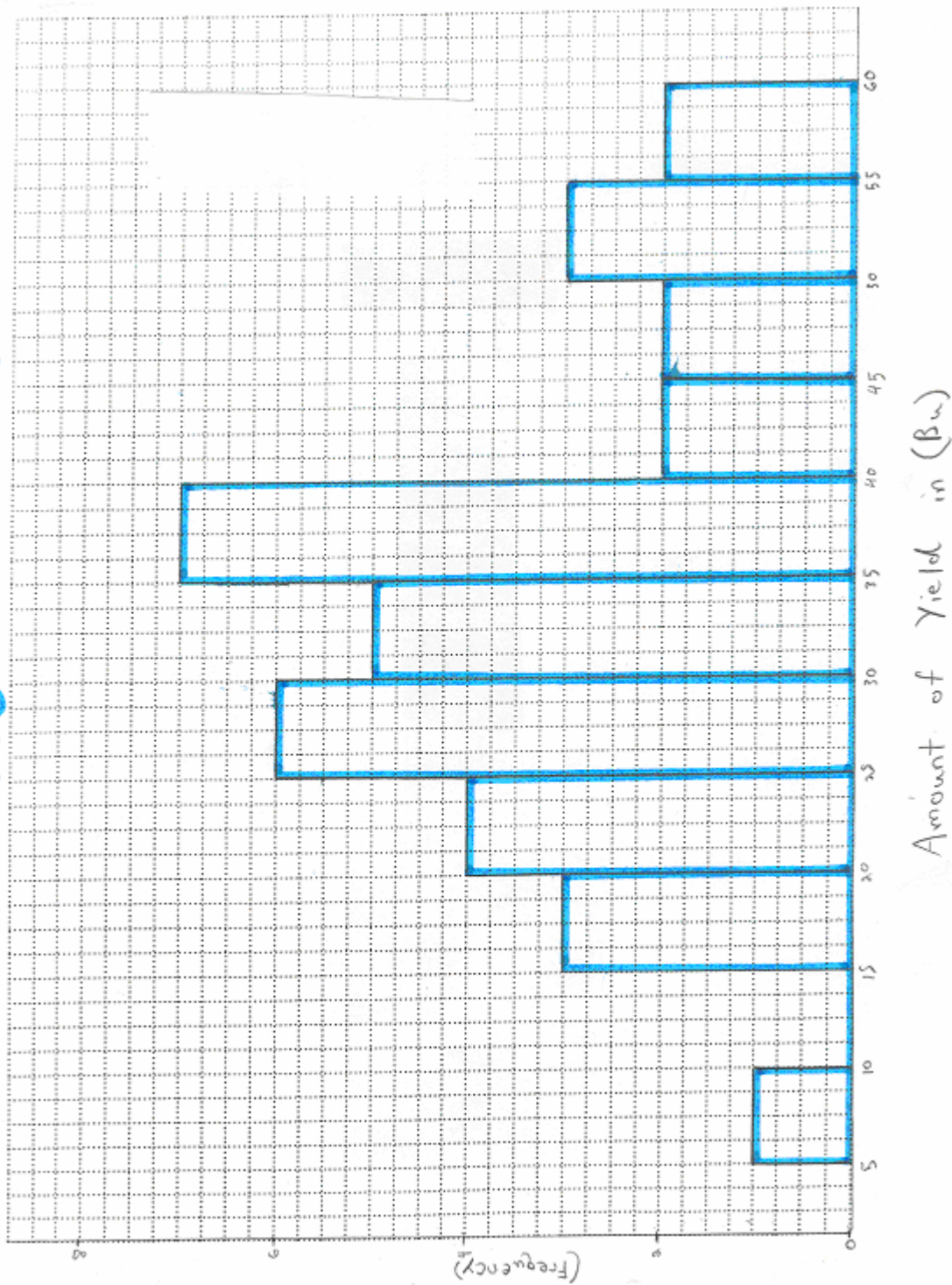# Spring Wheat

Mean- 26.3

Median- 27

Mode- 28

Range- 47.2

I conclude that winter wheat is better than spring wheat because its mean, median, mode, and range are all better than spring wheat statistics. Also the graphs seem to show that winter wheat has the majority of its yield in higher numbers than spring wheat. For the mode and the stem and leaf plot I used rounded numbers but for the rest I used them rounded to the nearest tenth.
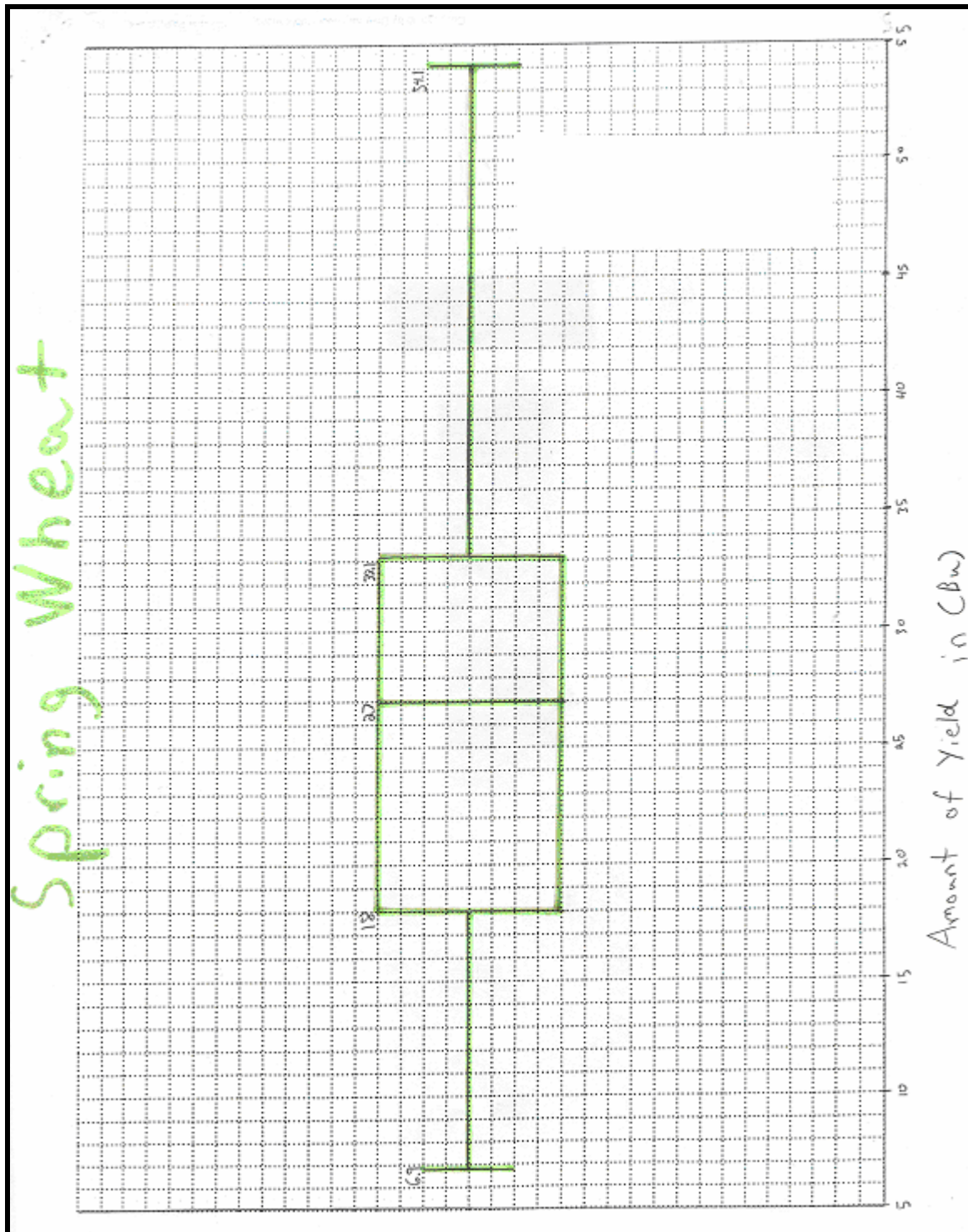
Sample #1 – Page 2

	Winter Wheat
0	9
1	6 8 9
2	2 2 3 3 5 6 9 9 9
3	0 3 3 3 4 4 6 6 7 7 8 8 8
4	1 2 6 7
5	1 2 2 5 8

Sample #1 – Page 3

Winter Wheat

Amount of Yield in (Bu)

Sample #1 – Page 4

Winter Wheat

Amount of Yield in (Bu)

(Frequency)

Sample #1 – Page 5

```
         Spring Wheat
  ──────────────────────────────────
  0  | 7 8 9

  1  | 2 3 7 7 8 8 9

  2  | 0 0 1 1 2 4 4 6 7 7 8 8 8 9

  3  | 0 1 3 5 6 9

  4  | 0 1 5 6

  5  | 4
```

Sample #1 – Page 6

Sample #1 – Page 7

Spring Wheat

Amount of Yield in (Bu)

(Frequency)
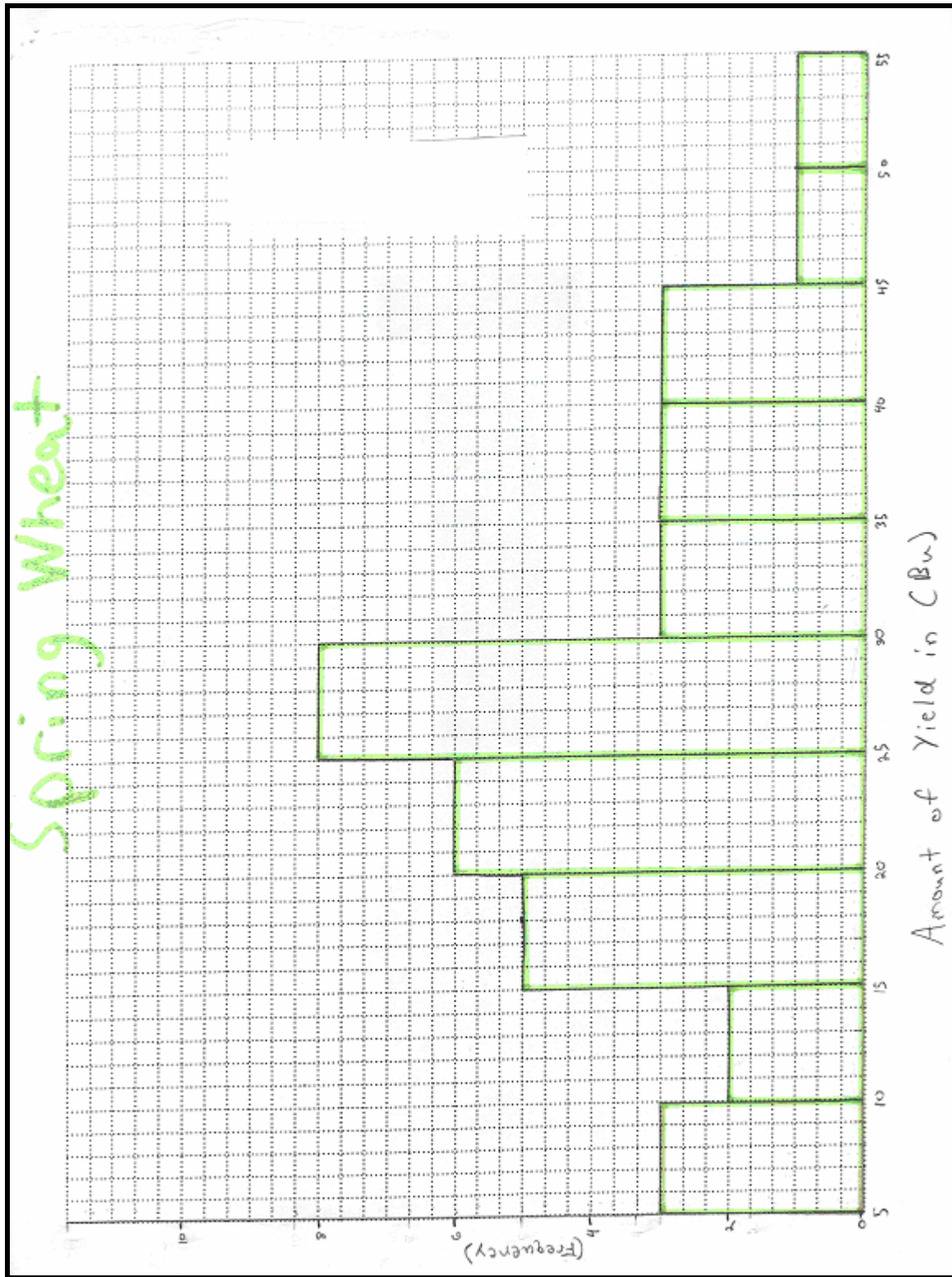
Looking at Student Work – Instructor notes and rating for work sample #1:

Category	Student Sample 1
8.S.1.2. Students are able to use a variety of visual representations to display data	Proficient
8.S.1.2. Uses displays of data to make comparisons and predictions	Advanced
Correctness of representation of data	Advanced
8.S.1.1. Students are able to find the mean, median, mode, and range of a data set from a stem-and-leaf plot and a line plot.	Advanced
Mathematical terminology and notation	Advanced
Neatness and organization	Advanced

The students' graphs were appropriate but lacked strong visual appeal. Students justified their conclusions based on statistical information.

Student Sample #2
Page 1

	Spring Wheat	Winter Wheat
mean	26.05 bu	34.02 bu
median	26 bu	34 bu
mode	24 bu	29, 34, 36, 37, 52 bu
range	47.2 bu	49 bu

Stem & Leaf Plot

Spring Wheat

```
0 | 6.9  8  9.3
1 | 1.9  3.3   6.8  7.1  7.6  8  9
2 | 0.1 0.5 1.1 2 4 4 5 6 7 7 8 8 8.4 8.5 9.5
3 | 0  1  3.1  6  9
4 | 0.4  0.7  4.9  5.6
5 | 4.1
```

Winter Wheat

```
0 | 9
1 | 5.7    7.6 8.8
2 | 2.2 2.4 3 3.2 5 6 8.7 9 9 9.9
3 | 2.9  3 3.3 4.4 6 6 7 7 7.8 7.9 8.1
4 | 1  2  6  7.1
5 | 1.2  2  2  5  8
```

Sample #2 – Page 2

In looking at the data after comparing each
one to each other, you could clearly see that
you rarely got over three fields with more
than 30 bushels per acre in the spring wheat. You
could see that with spring wheat you average between
15 to 30 bu per acre. Looking at the winter wheat
your averages increased to about 20 to 40 bu per
acre with a few fields reaching 58 bu per acre, the
spring wheat only reached 54.1 bu per acre.
So looking at the data I would recommend
planting winter wheat.
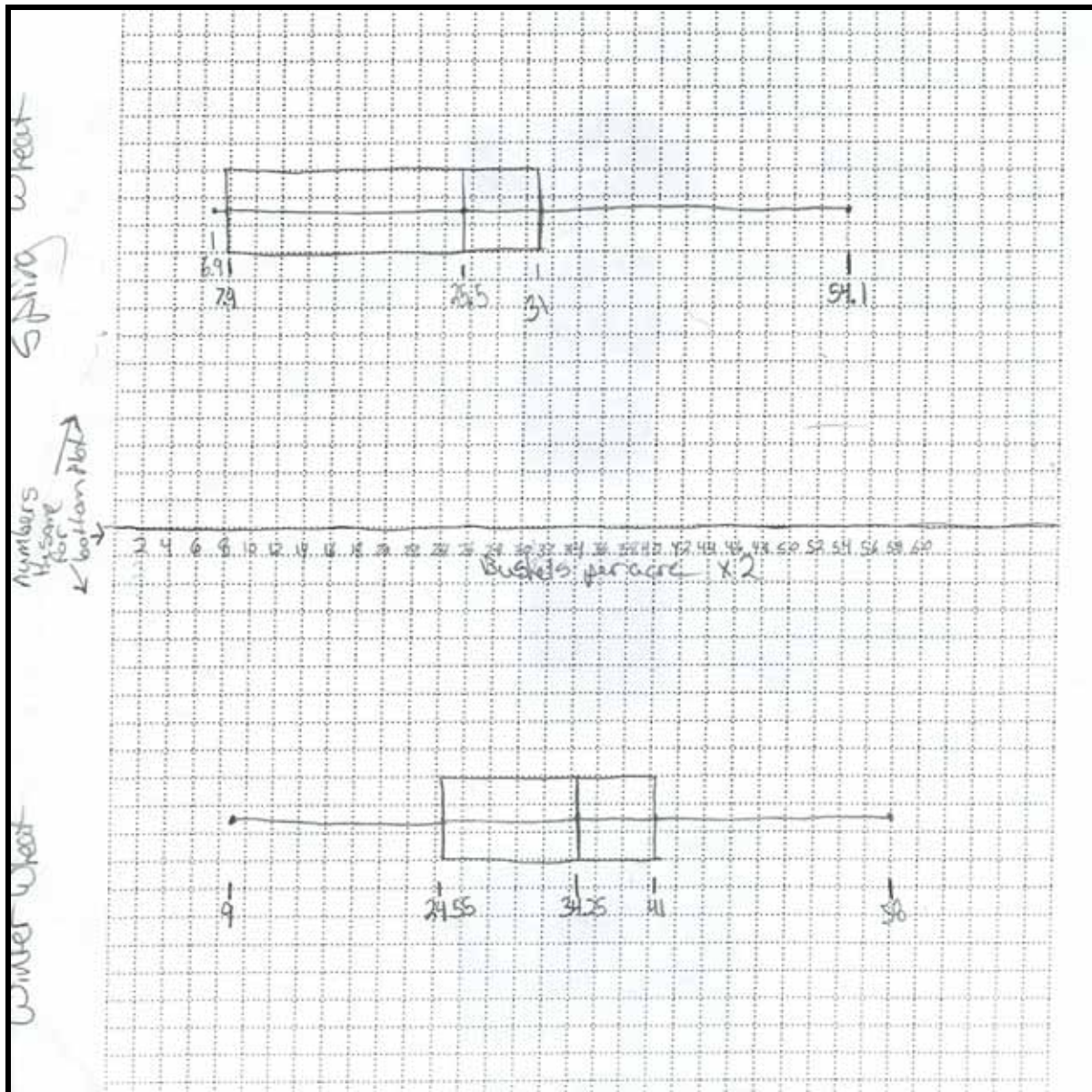
Sample #2 – Page 3

Sample #2 – Page 4
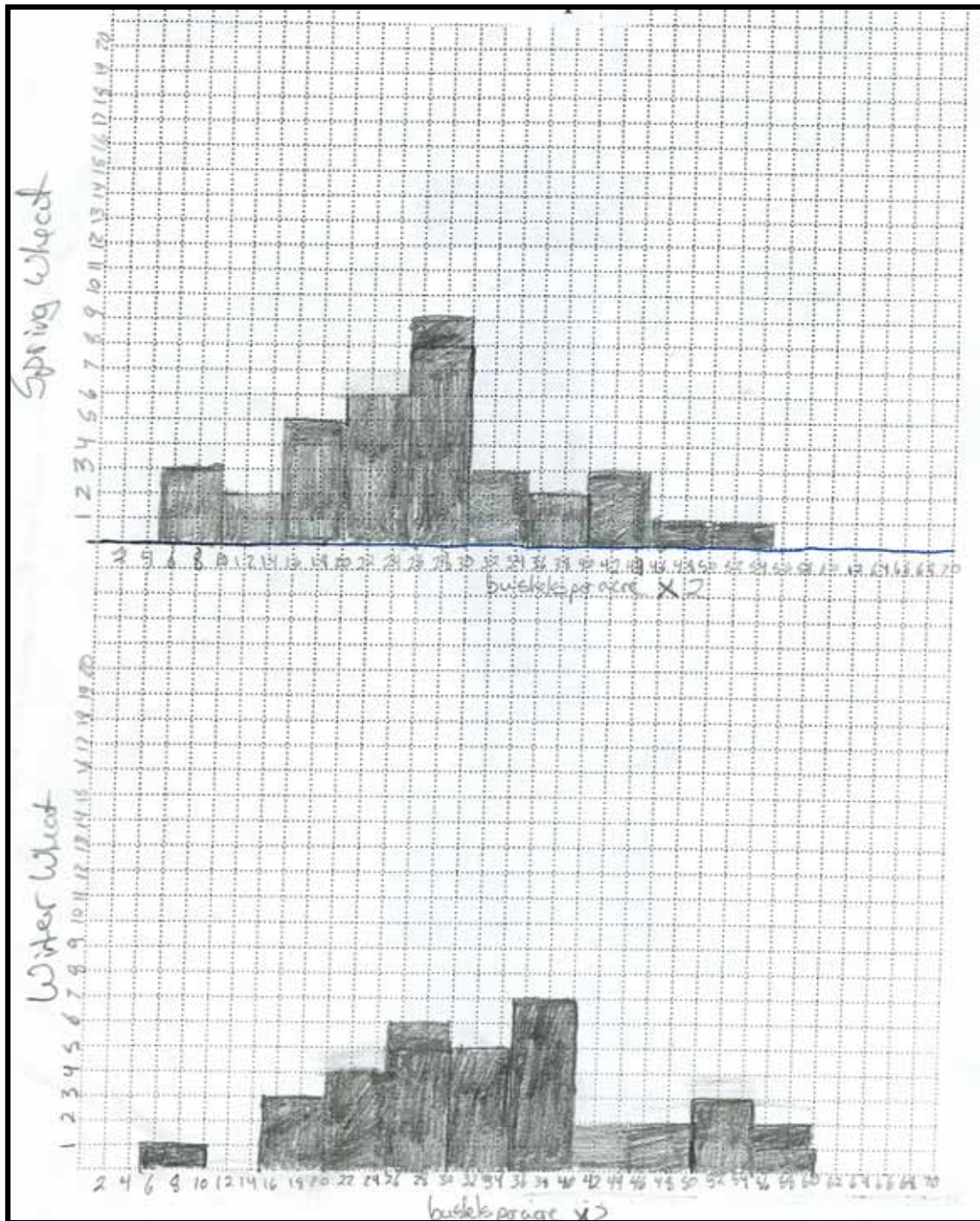
Looking at Student Work – Instructor notes and rating for work sample #2:
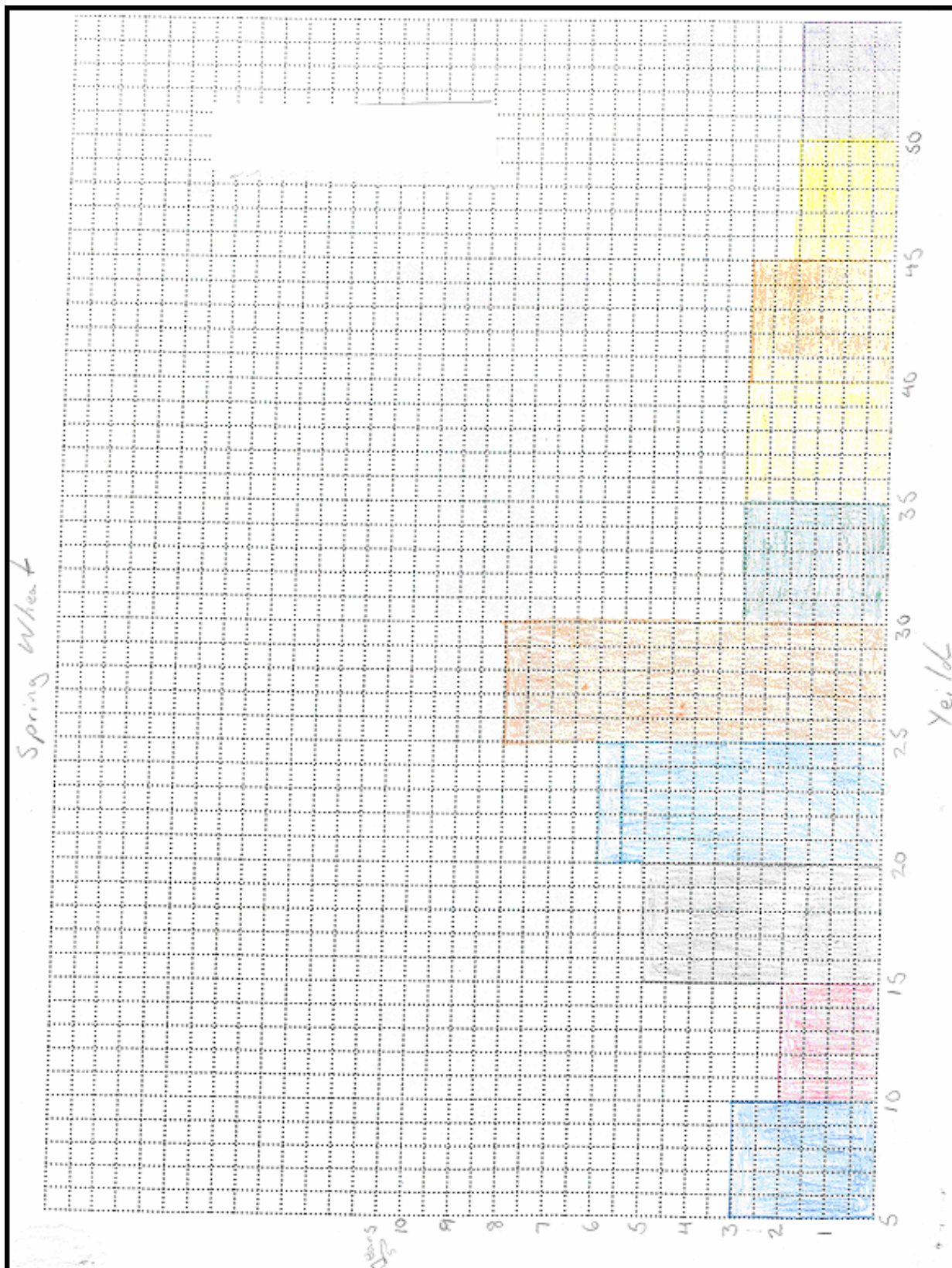
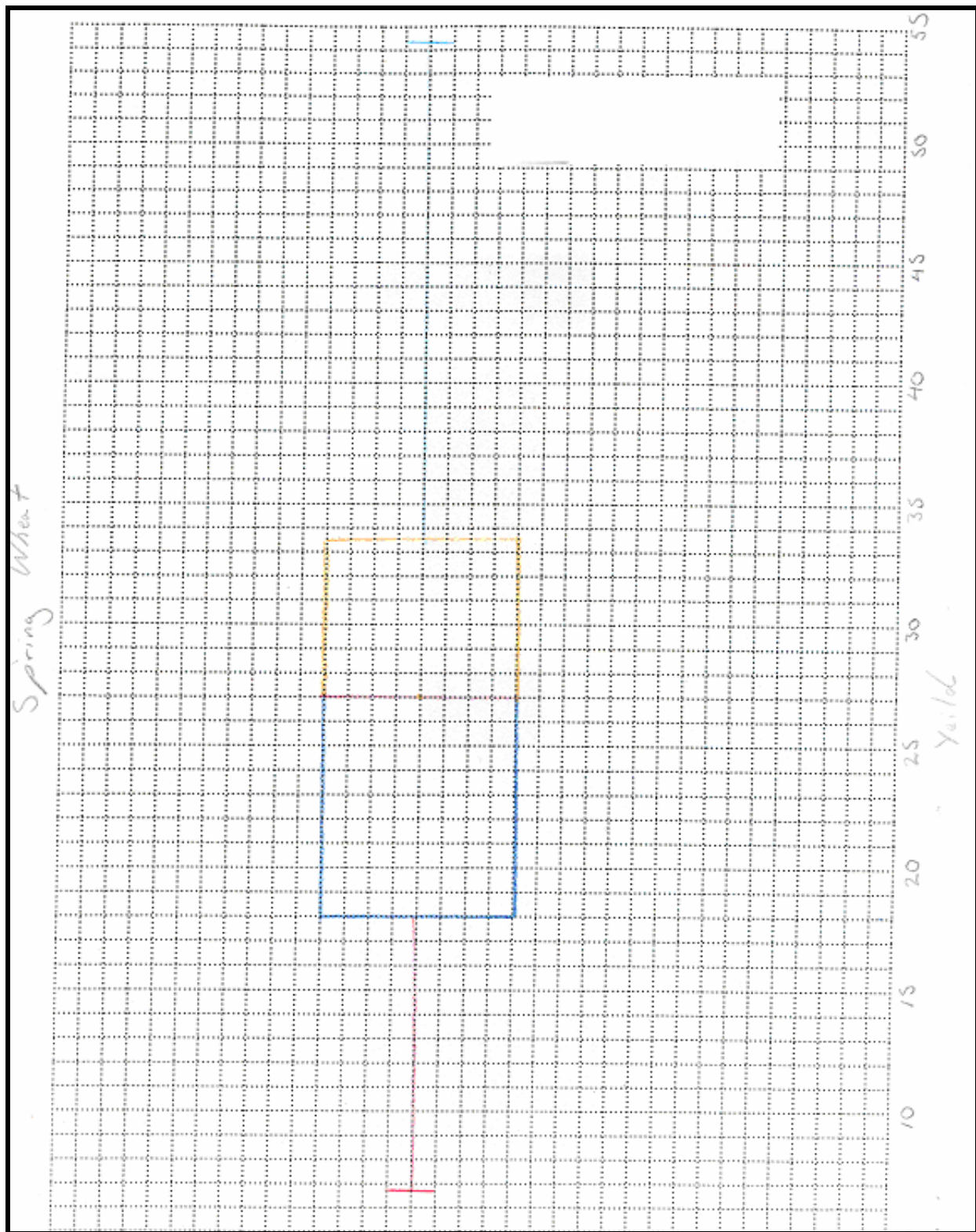| Category	Student Sample 2
8.S.1.2. Students are able to use a variety of visual representations to display data	Proficient.
8.S.1.2. Uses displays of data to make comparisons and predictions	Proficient.
Correctness of representation of data	Proficient.
8.S.1.1. Students are able to find the mean, median, mode, and range of a data set from a stem-and-leaf plot and a line plot.	Advanced
Mathematical terminology and notation	Basic
Neatness and organization	Proficient.

The students' graphs were appropriate but lacked strong visual appeal. I liked the fact that both sets of data were graphed on the same paper so they could easily be compared. The conclusions reached were justified using some, but not all of the data. They correctly represented the data, using a stem and leaf plot but lacked strong visual appeal. Some of the terminology used makes it difficult to understand. The use of the word "averages" is questionable. The work is neat and organized but at times is not completely clear.
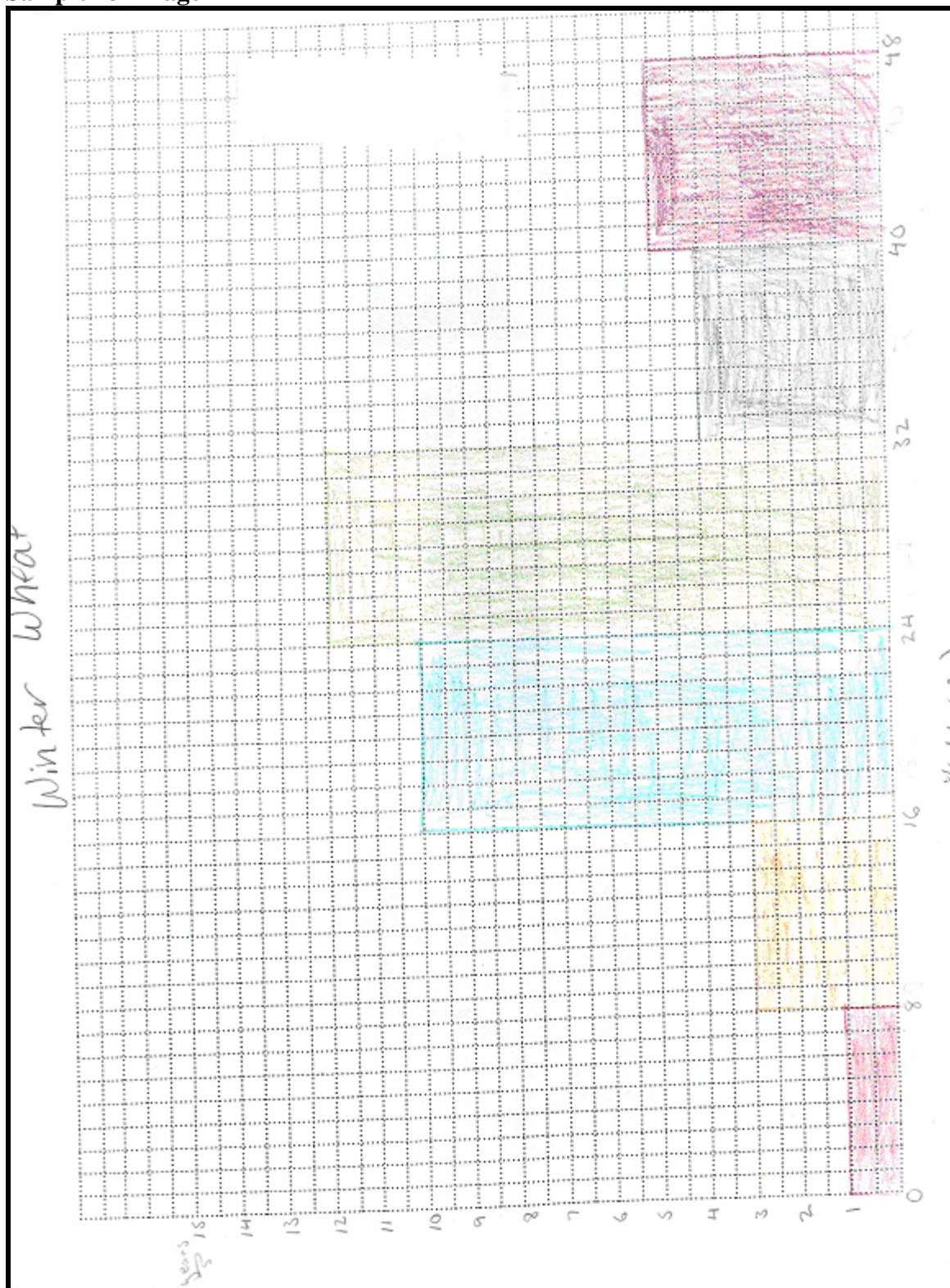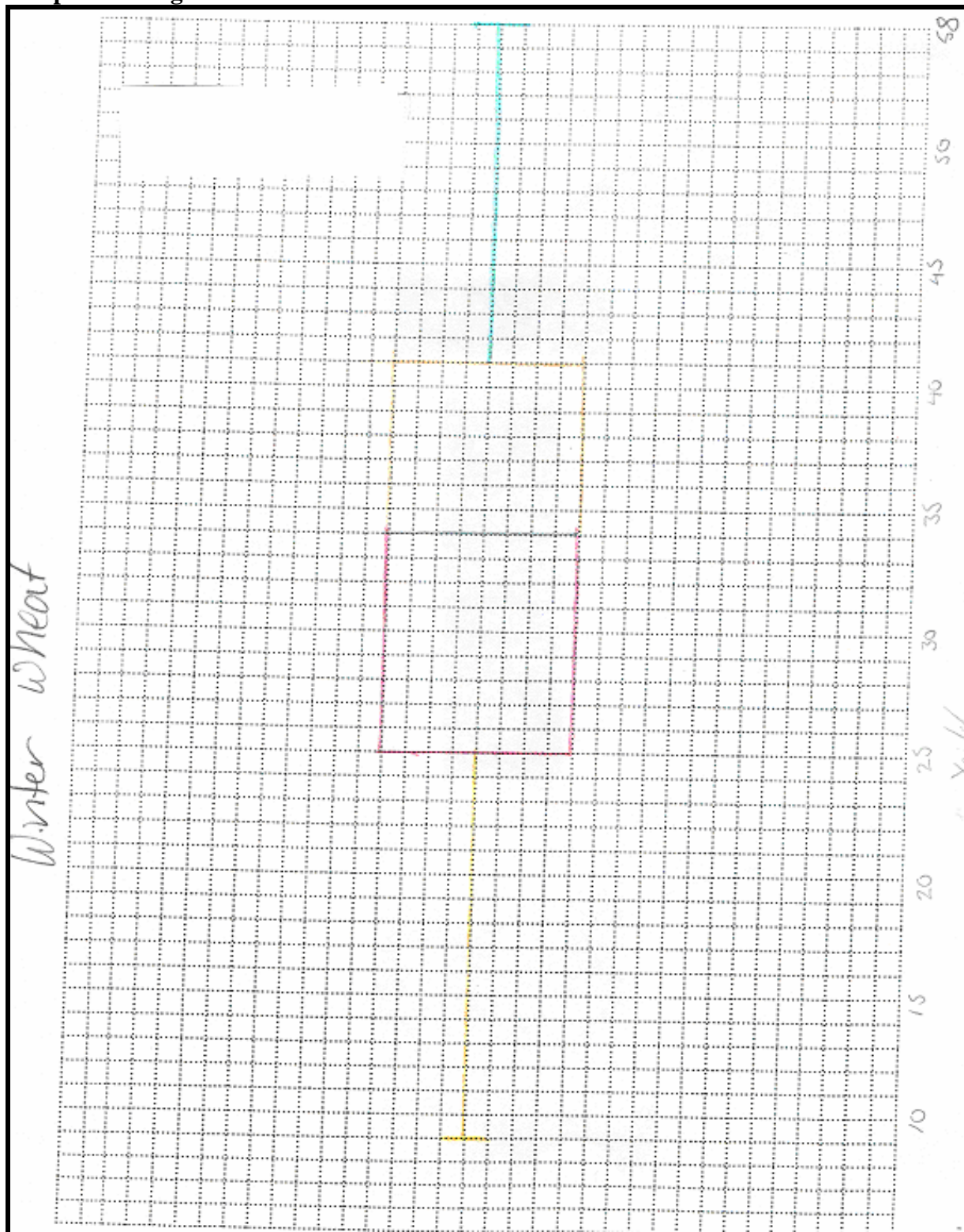
Student Sample #3
Page 1

I think that Winter Wheat would be the best choice. Thats because almost every year Winter Wheat has been more productive compared to Spring Wheat. Both Graphs present this. And so does the handed-out information.

Sample #3 – Page 2

Sample #3 – Page 3

Looking at Student Work – Instructor notes and rating for work sample #3:

Category	Student Sample 3
8.S.1.2. Students are able to use a variety of visual representations to display data	Proficient
8.S.1.2. Uses displays of data to make comparisons and predictions	Basic
Correctness of representation of data	Proficient
8.S.1.1. Students are able to find the mean, median, mode, and range of a data set from a stem-and-leaf plot and a line plot.	Below Basic
Mathematical terminology and notation	Below Basic
Neatness and organization	Proficient

The students' graphs were appropriate but lacked strong visual appeal. The conclusion was valid but not justified. The data was correctly represented but not with strong visual appeal. They failed to find any of the summary statistics although the box and whiskers plots appear to be correct. No mathematical terminology was used in the presentation.

INSTRUCTIONAL NOTES

Author Comments
Instead of providing the historical data for the wheat yields, the students could collect their own. They could then decide what data to use. The activity is designed to use only the historical data for the decision making, but certainly other factors exist. Class discussion or small group discussions could be used to discuss the other factors: timing of other fieldwork, irrigation or not, protein content, prices, etc.

Appropriate Technology
Computers or graphing calculators

Interdisciplinary Connections
Task can easily be connected to Agriculture programs.

Teacher and Student Web Resource
Quick Stats: Agricultural Statistics Data Base
   www.nass.usda.gov:81/ipedbcnty/c_SDcrops.htm

Resources
SD Mathematics Content Standards
   http://www.doe.sd.gov/contentstandards/math/index.asp
SD Assessment and Testing
   http://www.doe.sd.gov/octa/assessment/index.asp
The National Assessment of Educational Progress (NAEP)
   http://www.doe.sd.gov/octa/assessment/naep/index.asp
National Council of Teachers of Mathematics
   http://nctm.org/
Looking at Student Work
   http://www.lasw.org/index.html